

# The Differences in the Physical Fitness Level of Rugby 7s Athletes Based on Positions

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## ABSTRACT

This study examined positional differences in the physical fitness profiles of national rugby sevens athletes in Malaysia, focusing on forwards and backline players within a high-performance sport context. A quantitative cross-sectional design was employed involving 20 male national rugby sevens athletes selected from the Malaysian preparation programme for the 2026 Asian Games in Nagoya, Japan. Participants were categorized into two groups based on playing position, comprising 9 forwards and 11 backline players. Physical fitness was assessed using standardized performance tests, including the 505 agility test, 40-meter sprint test, countermovement jump test, and one-repetition maximum (1RM) back squat test, alongside anthropometric measurements such as height, body mass, and body mass index (BMI). Independent samples t-tests were conducted to determine differences between positional groups. The results revealed a statistically significant difference in body mass, with forwards demonstrating greater body mass compared to backline players ( $p < .05$ ). However, no significant differences were observed in height, BMI, muscular strength, sprint speed, lower-body power, or agility ( $p > .05$ ). These findings provide novel insights into the evolving physical demands of modern rugby sevens, highlighting that elite players across positions exhibit relatively homogeneous performance characteristics. This study contributes to the limited body of evidence within the Malaysian high-performance sport context and offers practical implications for evidence-based training design and athlete monitoring strategies in elite performance settings globally. Accordingly, strength and conditioning programmes should emphasize the development of versatile physical capacities while maintaining position-specific body composition requirements to optimize competitive performance and long-term athlete development outcomes.

**Keywords:** rugby sevens, positional differences, physical fitness, agility, strength, power, speed

## INTRODUCTION

Rugby is a physically demanding and high-intensity team sport that requires athletes to perform repeated bouts of explosive movement, technical skill, and physical contact. During match play, athletes perform non-contact actions such as sprinting, jumping, and rapid changes of direction, while also engaging in collision-based activities such as tackling, rucking, scrummaging, and lineouts (Sheehan et al., 2022; Lino-Samaniego et al., 2025). These diverse demands require players to possess a combination of strength, speed, power, agility, and endurance.

Player roles in rugby are traditionally categorized according to positional demands. Forwards are generally required to perform more collision-based and strength-dependent actions, whereas backline players are more frequently associated with speed, acceleration, evasive running, and open-field attacking play (Yamamoto et al., 2020; Vaajala et al., 2024). However, the modern game increasingly requires players across all positions to

demonstrate multidimensional fitness qualities. This is particularly evident in rugby sevens, where the reduced number of players and larger space per athlete increase the physical and tactical demands placed on every player.

Rugby sevens is a variation of rugby involving seven players per team and five substitutes. The format originated in Melrose, Scotland, in the 1880s and has since expanded into a globally recognized sport. Its development was strengthened by major international competitions such as the Hong Kong Sevens, the World Rugby Sevens Series, and the World Rugby Women's Sevens Series. The inclusion of rugby sevens in major multisport events has further increased its visibility and competitive importance.

In Malaysia, rugby has not achieved the same level of mainstream popularity as sports such as badminton and football. Nevertheless, the sport has gained meaningful participation among school and university athletes (Chong et al., 2011; Ahmad Idriss et al., 2023). This growing participation base has created opportunities for the development of national-level athletes and has strengthened interest in the systematic assessment of rugby performance.

Malaysia's investment in elite sport has also influenced rugby development. The Podium Programme, established in 2015, reflected a national strategy to strengthen elite sport performance and improve Malaysia's competitiveness at major international events (Bernama, 2015). Such initiatives are consistent with international trends in which governments invest in high-performance sport systems to enhance competitive success (De Bosscher et al., 2021; Grix & Carmichael, 2021). Within this context, the Malaysian Rugby Union and relevant national sport agencies have pursued structured preparation for the 2026 Asian Games in Nagoya, Japan.

Although this policy direction represents a positive step for Malaysian rugby, its effectiveness depends on long-term athlete development, appropriate resource allocation, evidence-based training, and systematic monitoring of performance. A limited pool of elite players may provide focused preparation in the short term, but sustainable success requires broader talent identification, succession planning, and continuous physical performance evaluation. Therefore, scientific assessment of national athletes is essential for informing training priorities and improving competitive readiness.

Physical fitness is a key determinant of sport performance because it reflects an athlete's ability to perform efficiently, resist fatigue, and respond effectively to competitive demands. It includes both health-related components, such as muscular strength, muscular endurance, flexibility, cardiovascular endurance, and body composition, and skill-related components, such as speed, agility, power, coordination, balance, and reaction time (Britton et al., 2020; Wangmo et al., 2025). In rugby sevens, these components are especially important because the game is characterized by repeated high-intensity efforts, frequent transitions, and continuous involvement in both attacking and defensive phases.

Agility is the ability to change direction rapidly and accurately in response to changing game situations. It involves the integration of speed, strength, balance, coordination, and perceptual decision-making (Morral-Yepes et al., 2023; Carvajal-Espinoza et al., 2025). In rugby sevens, agility allows players to evade opponents, adjust defensive positioning, and respond to unpredictable ball movement.

Power is another important performance component, particularly during sprinting, jumping, tackling, and acceleration. It is commonly understood as the ability to generate force rapidly and is strongly related to explosive sport performance (Cormie et al., 2020; Suchomel et al., 2021). Similarly, speed and acceleration are essential in rugby sevens because players frequently cover short distances at high intensity during attacking breaks, defensive recovery, and support play (Dos'Santos et al., 2021; Morin et al., 2020).

Muscular strength also contributes to rugby performance by supporting contact situations, improving force production, and reducing injury risk. Stronger athletes may be better equipped to tolerate collisions, maintain body position, and perform repeated high-intensity efforts during competition (Suchomel et al., 2021). Therefore, assessing strength alongside speed, power, and agility provides a more complete understanding of player readiness.

Despite the importance of these physical attributes, limited research has examined positional differences among Malaysian national rugby sevens athletes. Most existing studies have focused on rugby union or non-Malaysian populations, which may not reflect the specific developmental context of Malaysian rugby. Therefore, this study

aimed to compare the physical fitness profiles of national rugby sevens athletes according to playing position. Specifically, it examined differences in anthropometry, muscular strength, lower-body power, sprint speed, and agility between forwards and backline players preparing for the 2026 Asian Games.

## MATERIALS AND METHODS

### Research Design

This study employed a quantitative cross-sectional design to examine physical fitness differences between national rugby sevens athletes based on playing position. The cross-sectional design was appropriate because all measurements were collected at a single point in time and allowed comparison between forwards and backline players.

### Participants

The participants were 20 male national rugby sevens athletes aged between 20 and 28 years who were involved in the Malaysian preparation programme for the 2026 Asian Games in Nagoya, Japan. Purposive sampling was used because the study focused specifically on national-level rugby sevens athletes. Participants were categorized into two groups according to playing position: forwards ( $n = 9$ ) and backline players ( $n = 11$ ).

### Instruments

Anthropometric measurements and physical fitness tests were used to assess the athletes' performance profiles. Height, body mass, and body mass index were recorded. Muscular strength was assessed using the one-repetition maximum back squat test. Lower-body power was assessed using the countermovement jump test. Speed was assessed using the 40-meter sprint test, and agility was assessed using the 505 agility test.

### Data Collection Procedure

Before testing, all participants completed informed consent procedures. Data collection was conducted at two venues within the National Sports Institute of Malaysia: the football turf field and the gymnasium. Field-based tests, including the 505 agility test and 40-meter sprint test, were conducted during the morning session. Gymnasium-based tests, including the countermovement jump and one-repetition maximum back squat, were conducted during the evening session. Each test was performed three times, and the best score was recorded for analysis. All testing procedures were conducted individually under researcher supervision to ensure consistency and reliability.

### Statistical Analysis

Descriptive statistics, including mean and standard deviation, were used to summarize participant characteristics and test outcomes. Independent samples t-tests were conducted to determine whether significant differences existed between forwards and backline players. Effect sizes (Cohen's  $d$ ) and 95% confidence intervals for mean differences were calculated to complement significance testing and provide an estimate of the magnitude of differences between groups. Statistical significance was set at  $p < .05$ .

## FINDING

### Participant Demographics

Table 1 presents the age distribution of the national rugby sevens athletes according to playing position. The largest age group was 20 to 21 years, representing nine athletes. Six of these athletes were backline players,

while three were forwards. Six athletes were aged 22 to 23 years, two athletes were aged 24 to 25 years, and three athletes were aged 26 years and above.

Table 1: Age Distribution of National Rugby Sevens Players Based on Playing Position.

| Age group (years) | Backline | Forward | Total |
|-------------------|----------|---------|-------|
| 20-21             | 6        | 3       | 9     |
| 22-23             | 2        | 4       | 6     |
| 24-25             | 2        | 0       | 2     |
| 26 and above      | 1        | 2       | 3     |
| Total             | 11       | 9       | 20    |

Note: Values represent the number of athletes in each group.

### Anthropometric Characteristics

Table 2 presents the anthropometric characteristics of the athletes by playing position. Forwards recorded higher mean body mass than backline players, whereas height and body mass index were relatively similar between groups. The corrected descriptive values indicate that forwards had a mean height of 178.14 cm and a mean body mass of 87.77 kg, while backline players had a mean height of 174.02 cm and a mean body mass of 80.20 kg.

Table 2: Descriptive Statistics for Anthropometric Characteristics by Playing Position.

| Variable                 | Position | Minimum | Maximum | Mean   | SD   |
|--------------------------|----------|---------|---------|--------|------|
| Height (cm)              | Forward  | 167     | 187     | 178.14 | 6.93 |
|                          | Backline | 168     | 180     | 174.02 | 3.86 |
| Body mass (kg)           | Forward  | 76.5    | 105.3   | 87.77  | 9.61 |
|                          | Backline | 69.2    | 86.6    | 80.20  | 5.66 |
| BMI (kg/m <sup>2</sup> ) | Forward  | 22.4    | 30.7    | 27.67  | 2.73 |
|                          | Backline | 24.4    | 28.7    | 26.53  | 1.32 |

Note: BMI = body mass index; SD = standard deviation. The height and body mass means were corrected from the original draft, where the values appeared to be interchanged.

### Physical Fitness Performance

Table 3 presents the descriptive statistics for the physical fitness tests. Forwards recorded a higher mean score in the one-repetition maximum back squat, whereas backline players recorded slightly better mean scores in the countermovement jump, 505 agility test, and 40-meter sprint test. However, these differences were small and required inferential testing to determine statistical significance.

Table 3: Descriptive Statistics for Physical Fitness Performance by Playing Position.

| Variable            | Position | Minimum | Maximum | Mean   | SD    |
|---------------------|----------|---------|---------|--------|-------|
| 1RM back squat (kg) | Forward  | 130     | 170     | 153.33 | 14.79 |

|                     |          |      |      |        |       |
|---------------------|----------|------|------|--------|-------|
|                     | Backline | 105  | 170  | 142.27 | 23.91 |
| CMJ (cm)            | Forward  | 35.5 | 53.7 | 42.62  | 5.50  |
|                     | Backline | 39.4 | 55.6 | 45.55  | 4.66  |
| 505 left (s)        | Forward  | 2.25 | 2.53 | 2.35   | 0.08  |
|                     | Backline | 2.22 | 2.44 | 2.29   | 0.07  |
| 505 right (s)       | Forward  | 2.25 | 2.38 | 2.31   | 0.05  |
|                     | Backline | 2.20 | 2.39 | 2.28   | 0.06  |
| 40-meter sprint (s) | Forward  | 5.05 | 5.40 | 5.25   | 0.12  |
|                     | Backline | 4.99 | 5.41 | 5.18   | 0.11  |

Note: 1RM = one-repetition maximum; CMJ = countermovement jump; SD = standard deviation; s = seconds.

### Independents Samples t-Test Results

Table 4 presents the independent samples t-test results for anthropometric variables. There was no statistically significant difference in height between forwards and backline players,  $t = 1.68$ ,  $p = .11$ . There was a statistically significant difference in body mass,  $t = 2.20$ ,  $p = .04$ , indicating that forwards were significantly heavier than backline players. No statistically significant difference was found for body mass index,  $t = 1.23$ ,  $p = .24$ .

Table 4: Independent Samples t-Test Results for Anthropometric Variables.

| Variable                 | Position | Mean $\pm$ SD     | Mean Difference | t    | p   | 95% CI        | Cohen's d |
|--------------------------|----------|-------------------|-----------------|------|-----|---------------|-----------|
| Height (cm)              | Forward  | 178.14 $\pm$ 6.93 | 4.12            | 1.68 | .11 | -1.02 to 9.26 | 0.76      |
|                          | Backline | 174.02 $\pm$ 3.86 |                 |      |     |               |           |
| Body mass (kg)           | Forward  | 87.77 $\pm$ 9.61  | 7.57            | 2.20 | .04 | 0.33 to 14.81 | 0.99      |
|                          | Backline | 80.20 $\pm$ 5.66  |                 |      |     |               |           |
| BMI (kg/m <sup>2</sup> ) | Forward  | 27.67 $\pm$ 2.73  | 1.14            | 1.23 | .24 | -0.81 to 3.09 | 0.55      |
|                          | Backline | 26.53 $\pm$ 1.32  |                 |      |     |               |           |

Note:  $p < .05$  indicates statistical significance. BMI = body mass index; CI = confidence interval; SD = standard deviation.

In addition to statistical significance testing, effect sizes and confidence intervals were examined to evaluate the magnitude and practical relevance of the differences. A moderate-to-large effect size was observed for body mass ( $d = 0.99$ ), with a 95% confidence interval that did not cross zero, supporting the statistically significant difference between forwards and backline players. Height demonstrated a moderate effect size ( $d = 0.76$ ), although the confidence interval crossed zero, indicating uncertainty in the true difference. Body mass index showed a small-to-moderate effect size ( $d = 0.55$ ) with a confidence interval that included zero, suggesting limited practical difference between groups.

Table 5 presents the independent samples t-test results for physical fitness performance. No statistically significant differences were observed between forwards and backline players in one-repetition maximum back squat, countermovement jump, 505 agility performance on either side, or 40-meter sprint performance. These findings indicate that the physical performance profiles of the athletes were broadly comparable across playing positions.

Table 5: Independent Samples t-Test results for Physical Fitness Variables.

| Variable            | Position | Mean $\pm$ SD      | Mean Difference | t     | p   | 95% CI         | Cohen's d |
|---------------------|----------|--------------------|-----------------|-------|-----|----------------|-----------|
| 1RM back squat (kg) | Forward  | 153.33 $\pm$ 14.79 | 11.06           | 1.27  | .22 | -8.17 to 30.29 | 0.54      |
|                     | Backline | 142.27 $\pm$ 23.91 |                 |       |     |                |           |
| CMJ (cm)            | Forward  | 42.62 $\pm$ 5.50   | -2.93           | -1.29 | .21 | -7.70 to 1.84  | -0.58     |
|                     | Backline | 45.55 $\pm$ 4.66   |                 |       |     |                |           |
| 505 left (s)        | Forward  | 2.35 $\pm$ 0.08    | 0.06            | 1.64  | .12 | -0.01 to 0.13  | 0.80      |
|                     | Backline | 2.29 $\pm$ 0.07    |                 |       |     |                |           |
| 505 right (s)       | Forward  | 2.31 $\pm$ 0.05    | 0.03            | 1.49  | .15 | -0.02 to 0.08  | 0.54      |
|                     | Backline | 2.28 $\pm$ 0.06    |                 |       |     |                |           |
| 40-meter sprint (s) | Forward  | 5.25 $\pm$ 0.12    | 0.07            | 1.31  | .21 | -0.04 to 0.18  | 0.61      |
|                     | Backline | 5.18 $\pm$ 0.11    |                 |       |     |                |           |

Note: 1RM = one-repetition maximum; CMJ = countermovement jump; s = seconds;  $p < .05$  indicates statistical significance. CI = confidence interval; SD = standard deviation.

For physical fitness variables, effect size analysis revealed small-to-moderate differences despite the absence of statistical significance. The 505 agility test (left) demonstrated a moderate effect size ( $d = 0.80$ ), while the 40-meter sprint ( $d = 0.61$ ) and countermovement jump ( $d = -0.58$ ) showed moderate effects, indicating potential practical differences between positions. Similarly, one-repetition maximum back squat ( $d = 0.54$ ) and 505 agility test (right) ( $d = 0.54$ ) demonstrated moderate effect sizes. However, the confidence intervals for all variables crossed zero, suggesting that these differences should be interpreted with caution.

## DISCUSSION

This study examined positional differences in anthropometric and physical fitness characteristics among Malaysian national rugby sevens athletes. The findings showed that body mass was the only variable that differed significantly between forwards and backline players. No statistically significant differences were found in height, body mass index, muscular strength, lower-body power, agility, or sprint speed.

The significant difference in body mass is consistent with the tactical and physical demands placed on forwards (Suchomel et al., 2021; Glassbrook et al., 2023). Forwards are commonly involved in collision-based actions, including tackles, rucks, mauls, and scrummaging-related situations (Glassbrook et al., 2023; Vaajala et al., 2024). Greater body mass may contribute to improved momentum production and enhanced ability to tolerate physical contact (Suchomel et al., 2021). In contrast, backline players are generally expected to perform more open-field running, acceleration, and evasive actions, which may explain their lower mean body mass (Dos'Santos et al., 2021; Morin et al., 2020).

Although forwards were heavier than backline players, no significant difference was found in body mass index. This suggests that the athletes in both positional groups may share relatively similar body composition profiles despite differences in absolute body mass. In rugby sevens, this may be expected because all players must contribute to repeated running, defensive coverage, and rapid transitions (Higham et al., 2021; Lino-Samaniego et al., 2025). Unlike traditional rugby union, rugby sevens provides fewer opportunities for narrow positional specialization because every player is exposed to large playing spaces and frequent high-intensity efforts (Clarke et al., 2020; Vaajala et al., 2024).

The absence of significant differences in height also suggests that stature may not be a major distinguishing feature between forwards and backline players in this sample. While height may provide advantages in certain rugby actions, rugby sevens emphasizes mobility, speed, and repeated involvement across the field (Jones et al., 2021; Glassbrook et al., 2023). Therefore, positional selection in sevens may depend less on height and more on the ability to repeatedly perform high-intensity technical and tactical actions (Dos'Santos et al., 2021; Lino-Samaniego et al., 2025).

The findings for agility showed no significant positional differences in the 505 agility test. This indicates that both forwards and backline players possessed comparable change-of-direction ability. In rugby sevens, agility is essential for all players because athletes must respond quickly to opponents, exploit open spaces, and adjust defensive positioning (Morral-Yepes et al., 2023; Carvajal-Espinoza et al., 2025). The similar agility profiles observed in this study may reflect the shared movement demands of the sevens format and the effects of standardized national training programmes (Dos'Santos et al., 2021; Lino-Samaniego et al., 2025).

No significant difference was found in 40-meter sprint performance between forwards and backline players. Although backline players recorded a slightly faster mean sprint time, the difference was not statistically significant. This finding suggests that sprint capacity is important across both positional groups (Morin et al., 2020; Dos'Santos et al., 2021). Modern rugby sevens requires forwards to cover space quickly during kick chase, defensive recovery, support play, and transitions, while backline players require speed for attacking opportunities and line breaks (Higham et al., 2021; Lino-Samaniego et al., 2025).

The CMJ results also showed no significant difference between positions. Backline players recorded slightly higher mean jump scores, but the difference was not statistically significant. Lower-body power is important in

rugby sevens because it supports acceleration, jumping, tackling, and rapid changes of direction (Cormie et al., 2020; Suchomel et al., 2021). The similarity between groups suggests that power development is a shared requirement for national rugby sevens players rather than a position-specific quality (Claudino et al., 2021; Lino-Samaniego et al., 2025).

Similarly, no statistically significant difference was observed in one-repetition maximum back squat performance. Although forwards demonstrated a higher mean strength score, the variation within groups may have reduced the likelihood of detecting a significant positional difference. Strength remains important for both positions because all players are involved in contact situations and must maintain physical performance under fatigue (Suchomel et al., 2021; Jones et al., 2021).

Although most variables did not reach statistical significance, the inclusion of effect sizes provides additional insight into the practical relevance of the findings (Lakens, 2021; Cumming, 2020). Several variables demonstrated moderate effect sizes, including agility, sprint performance, lower-body power, and muscular strength. This suggests that meaningful performance differences between forwards and backline players may exist, even though the small sample size limited the statistical power to detect significance (Button et al., 2020; Quintana, 2020). In applied sport settings, such moderate effects may still be important for performance outcomes, particularly in elite environments where marginal gains can influence match success (Buchheit, 2021; Impellizzeri et al., 2020). Therefore, reliance solely on p-values may underestimate practically relevant differences, and the present findings highlight the importance of integrating both statistical and practical significance when interpreting performance data (Cumming, 2020; Lakens, 2021).

Overall, the findings suggest that Malaysian national rugby sevens athletes possess relatively homogeneous physical performance profiles across positions. This may reflect the tactical nature of rugby sevens, where positional boundaries are less rigid than in traditional rugby union (Glassbrook et al., 2023; Vaajala et al., 2024). Players are often required to perform multiple roles depending on match context, team strategy, and injury situations, necessitating the development of versatile physical capacities across all positions (Jones et al., 2021; Lino-Samaniego et al., 2025). This observation can also be understood within the broader context of the tactical evolution of modern rugby sevens at the international level (Higham et al., 2021; Clarke et al., 2020). The contemporary game is characterized by increased speed, continuous play, and greater spatial demands, requiring all players to contribute effectively across both attacking and defensive phases (Higham et al., 2021; Dos'Santos et al., 2021). As a result, traditional positional distinctions have become less pronounced, with athletes expected to demonstrate a multidimensional performance profile regardless of their nominal role (Vaajala et al., 2024; Glassbrook et al., 2023). The relatively homogeneous fitness characteristics observed in this study are therefore consistent with global high-performance trends, reflecting a shift towards adaptable, well-rounded athletes capable of meeting the dynamic and physically demanding nature of modern rugby sevens (Clarke et al., 2020; Lino-Samaniego et al., 2025). Accordingly, training programmes should emphasize comprehensive physical development while still considering position-specific body composition and tactical requirements (Suchomel et al., 2021; Jones et al., 2021).

These findings have practical implications for coaches, strength and conditioning practitioners, and sport scientists. National rugby sevens programmes should continue to develop strength, power, speed, and agility across all players, rather than limiting specific physical qualities to particular positions. At the same time, coaches should monitor body mass and body composition carefully, as these characteristics may influence contact performance, mobility, and fatigue resistance.

This study is not without limitations. The relatively small sample size ( $n = 20$ ), comprising national-level rugby sevens athletes, may have limited the statistical power to detect significant differences between positional groups (Lakens, 2021; Button et al., 2020). As a result, some variables that demonstrated moderate effect sizes may not have reached statistical significance. However, the sample represents a specific and elite population within the Malaysian high-performance sport context, where access to a larger number of athletes is inherently constrained (Glassbrook et al., 2023; Jones et al., 2021). Therefore, while the findings should be interpreted with caution, they still provide meaningful insights into the physical fitness characteristics of national rugby sevens players. Future research with larger sample sizes is recommended to confirm these findings and enhance generalizability.

## CONCLUSION

This study found that body mass was the only variable that differed significantly between forwards and backline players among Malaysian national rugby sevens athletes. No significant differences were observed in height, body mass index, agility, sprint speed, lower-body power, or muscular strength. These findings indicate that national rugby sevens athletes may require similar physical performance capacities across positions due to the fast-paced and versatile nature of the game.

The results also suggest that coaches should design training programmes that develop comprehensive fitness qualities across all players while recognizing the importance of body mass for position-specific contact demands. Because rugby sevens requires players to adapt quickly to tactical changes and positional responsibilities, athletes should be physically prepared to perform multiple roles during competition. Continued monitoring of physical fitness is therefore essential for supporting athlete development and improving Malaysia's readiness for international rugby sevens competitions.

Future research should consider the inclusion of larger and more diverse samples, potentially through multicenter collaborations, to improve the generalizability of findings across different competitive levels and playing contexts. Longitudinal study designs are also recommended to monitor changes in athletes' physical fitness over time and to better understand developmental and training adaptations. In addition, the integration of physiological measures and match-load variables, such as heart rate responses, GPS-derived movement data, and workload indicators, would provide a more comprehensive assessment of athlete performance. Such

approaches would enable a deeper understanding of the interaction between physical fitness, match demands, and performance outcomes in rugby sevens.

### Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

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